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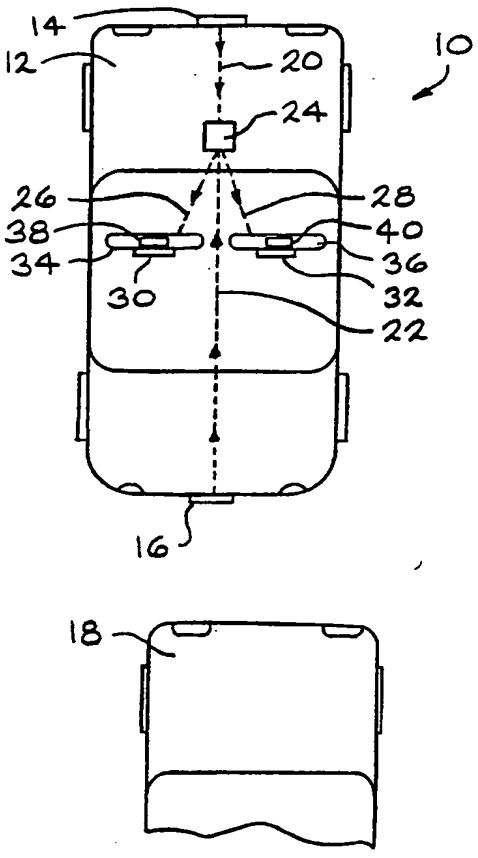
(54) Title: APPARATUS FOR MOVING VEHICLE HEADREST



(57) Abstract: An apparatus (10) for a vehicle includes a sensor (14, 16) for connecting to a first vehicle (12), and for sensing position and movement of a second vehicle (18) relative to the first vehicle (12). The apparatus also includes a controller (24) responsive to the sensor (14, 16) for predicting an impending collision of the first and second vehicles. The apparatus also includes an actuator (30, 32) responsive to the controller (24) for actuating movement of a headrest (38, 40) of the first vehicle (12) from a first position to a second position, the movement being initiated prior to the collision.

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TITLE

APPARATUS FOR MOVING VEHICLE HEADREST

Inventor: Mladen Humer

BACKGROUND OF THE INVENTION

This invention relates in general to apparatus for vehicles, and in particular to an apparatus for moving a vehicle headrest prior to a crash of the vehicle.

The front seats of a vehicle are usually provided with headrests for the vehicle occupants. The head of the occupant is usually positioned a distance in front of the headrest during normal operation of the vehicle. However, when the vehicle is involved in a crash, the head of the occupant often moves back and hits the headrest. For example, a rear collision of the vehicle causes the head of the occupant to move back rapidly relative to the occupant' s chest until the head hits the headrest. A front collision of the vehicle causes the head of the occupant to move forward and then bounce back. Other crashes such as spins or flips of the vehicle may also cause the head of the occupant to move back and hit the headrest. If the distance between the headrest and the occupant' s head is relatively large, the rearward movement of the occupant' s head may cause injury to the head and/or neck of the occupant, such as a whiplash injury.

One way to address this problem is to move the headrest forward and upward in the event of a crash so that it is adjacent to the head of the occupant. It is known to equip the headrest with an actuator that is triggered after a crash has occurred to move the headrest forward and upward relative to the initial position, similar to the way that an airbag is actuated by a crash. This approach has some drawbacks, however. When the movement of the headrest is triggered by a crash, a minimal amount of time exists to move the headrest before the head of the occupant moves backward. Consequently, an actuator such as a stored energy system, e.g., a pyrotechnic device, must move the headrest in a very rapid amount of time. If the headrest is not moved soon enough, the rapidly moving headrest may collide with the head of the occupant during its rearward

movement, possibly causing an even more severe injury to the occupant. The occupant may also be injured if the headrest is actuated accidentally.

SUMMARY OF THE INVENTION

This invention relates to an apparatus for a vehicle including a sensor for sensing an impending crash of the vehicle, and an actuator responsive to the sensor for actuating movement of a headrest of the vehicle from a first position to a second position. The movement of the headrest is initiated by the actuator prior to the impending crash.

In another embodiment, the invention relates to an apparatus for a vehicle including a sensor for connecting to a first vehicle, and for sensing position and movement of a second vehicle relative to the first vehicle. The apparatus also includes a controller responsive to the sensor for predicting an impending collision of the first and second vehicles. The apparatus also includes an actuator responsive to the controller for actuating movement of a headrest of the first vehicle from a first position to a second position, the movement being initiated prior to the impending collision.

Various advantages of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiment, when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic plan view of a vehicle equipped with an apparatus for moving a headrest in accordance with the invention.

Fig. 2 is a schematic side view of a vehicle seat having a headrest, the headrest being moved from a rearward and downward position to a forward and upward position by the apparatus of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention relates to an apparatus for moving a vehicle headrest prior to a crash of the vehicle. The apparatus can work with any type of vehicle and any type of impending crash. The crash can be a collision, such as a front collision, a rear collision, or a side collision. The collision can be a collision with another vehicle, with a stationary roadside obstacle, or any other type of collision. The crash can also be a crash not involving a collision, such as a spin, a flip, or a turnover.

Referring now to the drawings, there is illustrated in Figs. 1 and 2 an apparatus 10 according to the invention for moving a vehicle headrest prior to a crash. As shown in Fig. 1, a first vehicle 12 is equipped with a front sensor 14 and a rear sensor 16. The front sensor 14 is adapted to sense an impending front crash of the vehicle 12, and the rear sensor 16 is adapted to sense an impending rear crash of the vehicle 12. The vehicle 12 could be equipped with only one of the front and rear sensors 14 and 16, or it could be equipped with additional sensors such as side sensors (not shown).

The sensors 14 and 16 are adapted to sense a crash of the vehicle 12 prior to the crash taking place. To accomplish this, the sensors 14 and 16 are adapted to sense conditions that are predictive of an impending crash. In a preferred embodiment, the sensors 14 and 16 are proximity sensors which are adapted to sense position and/or movement of a second vehicle 18 relative to the first vehicle 12. The sensed movement is usually velocity and acceleration of the second vehicle 18 relative to the first vehicle 12. Preferably, the sensors 14 and 16 are adapted to sense position and movement of a plurality of vehicles in the near vicinity of the first vehicle 12. The sensors 14 and 16 can accomplish these functions in any suitable manner. Usually, the sensors 14 and 16 send out waves and receive feedback from the waves to sense the impending crash. Suitable waves include microwaves, infrared waves, ultrasound waves, radio waves, electromagnetic waves, laser beams, and others. The illustrated sensors 14 and 16 are adapted to generate signals 20 and 22 that are representative of the sensed conditions predictive of the impending crash.

Preferably, the apparatus 10 also includes a controller 24 responsive to the sensors 14 and 16 which is adapted to predict an impending crash of the vehicle 12. The controller 24 can be a computer or any other suitable electronic controlling device known in the art. The controller 24 is adapted to receive the signals 20 and 22 generated by the sensors 14 and 16. The controller 24 can perform the predictive function in any suitable manner. Preferably, the controller 24 uses an algorithm which is adapted to predict the impending crash based on the sensed conditions, such as the sensed position and movement of the second vehicle. In the illustrated embodiment, the controller 24 generates first and second signals 26 and 28 representative of the predicted crash.

The illustrated apparatus 10 also includes first and second actuators 30 and 32 mounted in first and second seats 34 and 36 of the vehicle 12. The first and second seats 34 and 36 have first and second headrests 38 and 40, respectively. Of course, any suitable number of seats and respective headrests can be actuated according to the invention. The actuators 30 and 32 are responsive to the sensors 14 and 16, or responsive to the controller 24 when the apparatus includes a controller 24. The actuators 30 and 32 are adapted to receive the signals 26 and 28 generated by the controller 24. As shown in Fig. 2, the actuator 30 is adapted to actuate movement of the headrest 38 mounted on the seat 34 from a first position 38a (shown by phantom lines) to a second position 38b (shown by solid lines). Preferably, the first position 38a is a rearward and downward position (the position during normal operation of the vehicle), and the second position is a forward and upward position closer to the head (not shown) of the vehicle occupant. The movement of the headrest 38 from the first position 38a to the second position 38b is at least initiated by the actuator 30 prior to the crash, because of the predictive aspects of the apparatus 10. In some instances, the movement of the headrest 38 is completed prior to the crash. Suitable actuators for moving objects such as vehicle headrests are well known in the art. The actuator 30 can be connected to the headrest 38 by any suitable linkage (not shown), as is well known in the art.

Because the apparatus 10 senses/predicts the crash prior to the crash taking place, the actuator 30 has sufficient time to move the headrest 38 to the second position without the use of a fast responsive system, such as a stored energy system such as a pyrotechnic device. Compared with an actuator which is triggered by a crash taking place, the actuator 30 of the apparatus 10 has much more available time for deployment. For example, a stored energy system that triggers during impact should actuate a headrest in about 0.025 seconds. In contrast, the predictive apparatus 10 of the present invention may increase the time available for actuation to about 0.2 to 0.5 seconds in some embodiments of the invention.

The increase in the time available for deployment allows a much lower actuation velocity. For example, the actuator 30 of the invention can be an electric motor instead of pyrotechnics or other fast acting energy systems. Because of the slower deployment, risk of injury due to inadvertent actuation is greatly reduced. The use of an electric motor as the actuator 30 can allow both forward and vertical movement of the headrest 38. The vertical movement can be optimized for the occupant. Two electric motors (not shown) can also be used with a powered 4-way headrest. In a preferred embodiment, the actuator 30 re-sets automatically after actuation after a predetermined amount of time, that is, the actuator 30 moves the headrest 38 from the second position 38b to the first position 38a at a predetermined time interval after the initial actuation. The actuator 30 can also be a compressed spring. In one embodiment, the actuator 30 includes a spring and a damper with a controlled deployment velocity.

In accordance with the provisions of the patent statutes, the principle and mode of operation of this invention have been explained and illustrated in its preferred embodiment. However, it must be understood that this invention may be practiced otherwise than as specifically explained and illustrated without departing from its spirit or scope.

What is claimed is:

1. An apparatus for a vehicle comprising:

a sensor for sensing an impending crash of the vehicle; and

an actuator responsive to the sensor for actuating movement of a headrest of the vehicle from a first position to a second position, the movement being initiated prior to the crash.

2. The apparatus defined in Claim 1 wherein the second position of the headrest is forward and upward relative to the first position.

3. The apparatus defined in Claim 1 wherein the sensor sends out waves and receives feedback from the waves to sense the impending crash.

4. The apparatus defined in Claim 1 wherein the sensor is mounted at the rear of the vehicle for sensing an impending rear collision of the vehicle.

5. The apparatus defined in Claim 1 wherein the sensor is mounted at the front of the vehicle for sensing an impending front collision of the vehicle.

6. The apparatus defined in Claim 1 wherein the actuator is a motor.

7. The apparatus defined in Claim 1 wherein the actuator is a spring.

8. An apparatus for a vehicle comprising:

a sensor for connecting to a first vehicle, and for sensing position and movement of a second vehicle relative to the first vehicle;

a controller responsive to the sensor for predicting an impending collision of the first and second vehicles; and

an actuator responsive to the controller for actuating movement of a headrest of the first vehicle from a first position to a second position, the movement being initiated prior to the collision.

9. The apparatus defined in Claim 8 wherein the controller uses an algorithm for predicting the impending collision based on the sensed position and movement of the second vehicle.

10. The apparatus defined in Claim 8 wherein the second position of the headrest is forward and upward relative to the first position.

11. The apparatus defined in Claim 8 wherein the sensor sends out waves and receives feedback from the waves to sense the impending collision.

12. The apparatus defined in Claim 8 wherein the sensor is mounted at the rear of the first vehicle for sensing an impending rear collision of the first vehicle.

13. The apparatus defined in Claim 8 wherein the sensor is mounted at the front of the first vehicle for sensing an impending front collision of the first vehicle.

14. The apparatus defined in Claim 8 wherein the sensor senses position, velocity and acceleration of the second vehicle relative to the first vehicle.

15. The apparatus defined in Claim 8 wherein the actuator is a motor.

16. The apparatus defined in Claim 8 wherein the actuator is a spring.

17. The apparatus defined in Claim 8 wherein the actuator moves the headrest from the second position to the first position at a predetermined time interval after the initial actuation.

18. The apparatus defined in Claim 8 wherein the movement of the headrest is completed prior to the collision.

19. The apparatus defined in Claim 8 wherein the movement of the headrest is initiated at least about 0.2 seconds prior to the collision.

20. An apparatus for a vehicle comprising:

a sensor for connecting to a first vehicle, and for sensing position, velocity and acceleration of a second vehicle relative to the first vehicle;

a controller responsive to the sensor and using an algorithm for predicting an impending collision of the first and second vehicles based on the sensed position, velocity and acceleration of the second vehicle; and

an actuator responsive to the controller for actuating movement of a headrest of the first vehicle from a first position to a second position which is forward and upward relative to the first position, the movement being initiated prior to the collision.

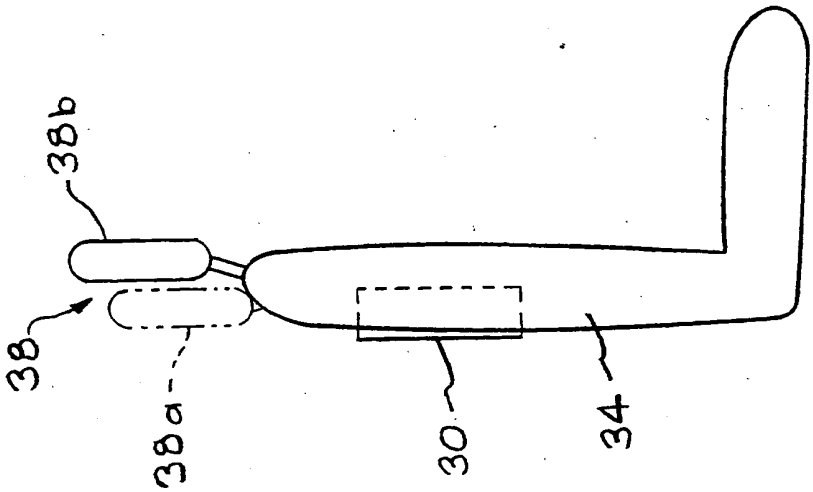

FIG. 2

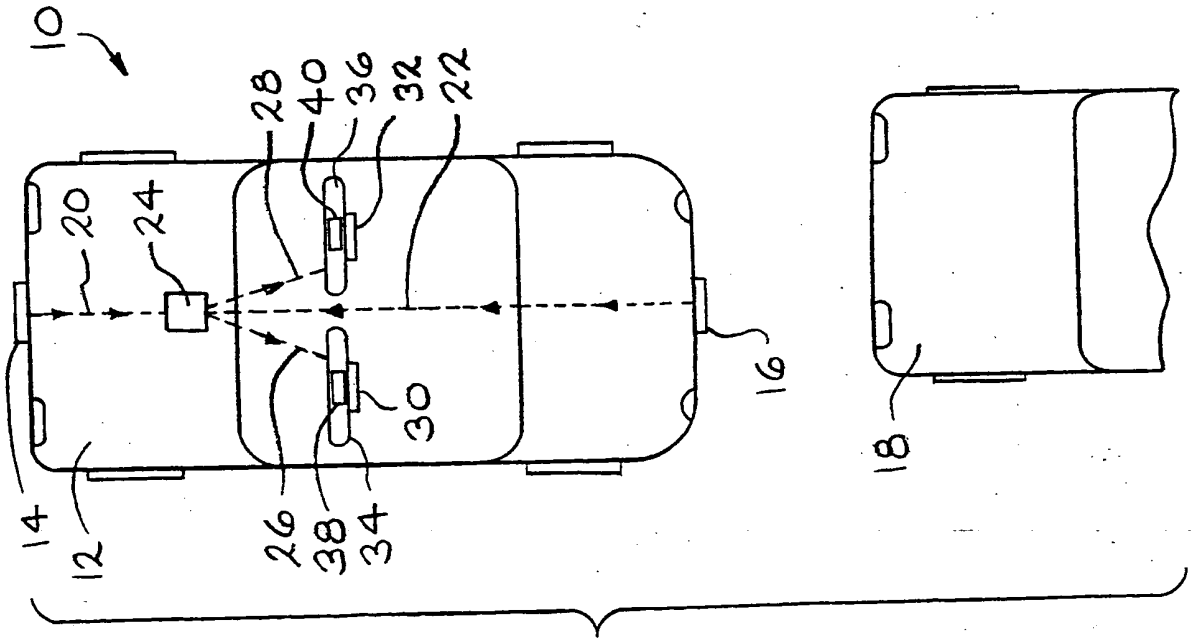

FIG. 1

INTERNATIONAL SEARCH REPORT

onal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60N2/427 B60N2/48 B60R21/01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B60N B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 301 906 A (AUTOMOTIVE TECHNOLOGIES INTERNATIONAL INC) 18 December 1996 (1996-12-18) abstract	1-6, 8-15, 17-20
A	page 5, line 6 -page 9, line 21; figures 1-7	7,16
X	DE 39 00 495 A (BAYERISCHE MOTOREN WERKE AG) 26 July 1990 (1990-07-26) abstract	1,3,7,8, 11,16-19
A	column 2, line 12 -column 3, line 35; claims 1-7; figure 1	2,4,5,9, 10, 12-14,20
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
13 March 2001	20/03/2001

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 927 804 A (JESS A. CUEVAS) 27 July 1999 (1999-07-27) abstract; figures 1-4	1-8,10, 15-17,20

1

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Information on patent family members

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